

Finite Element Models for Electron Beam Freeform Fabrication Process, Phase I

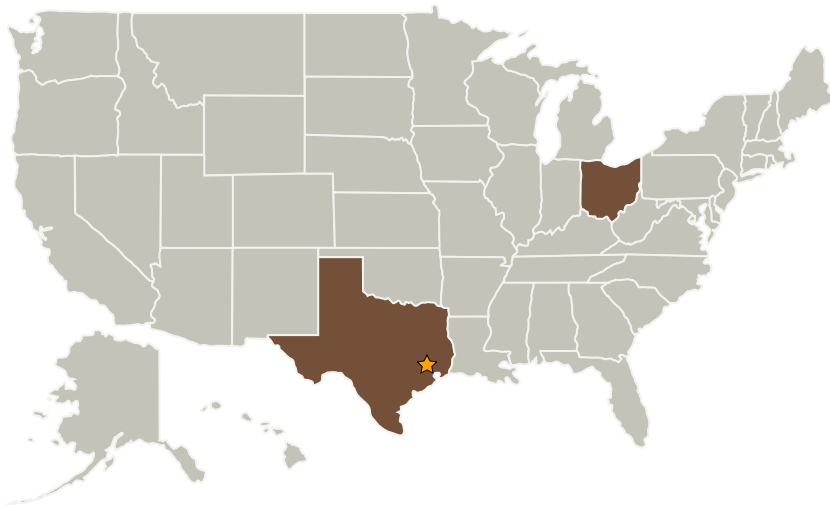
Completed Technology Project (2005 - 2005)



Project Introduction

This Small Business Innovation Research proposal offers to develop the most accurate, comprehensive and efficient finite element models to date for simulation of the material deposition processes; especially the electron beam freeform fabrication process. Phase I will deal with the basic thermal and mechanical (stress and distortion) models. A new scheme to model material deposition will be attempted; its feasibility will be tested on multi-pass deposits. A commercial finite element analysis code, ABAQUS, will be used to which a new capability for prediction of morphology will be added. During Phase II, several other key modeling issues such as the prediction of grain size, study of the effect of convection in the melt pool, parametric study, experimental validation, simulation of a demonstration part, and on-line process control will be addressed. These models will be applicable to ground-based as well as space-based systems. They will assist in understanding the effects of the various process parameters (e.g., power, feed rate, traverse speed and gravity) on variables defining the product quality; e.g., interlayer fusion, morphology, grain size, stresses and distortion. The models will also be applicable to laser, TIG and other metal deposition processes.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission
Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation
Research/Small Business Tech
Transfer

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Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Modern Computational Technologies, Inc.	Supporting Organization	Industry	Cincinnati, Ohio

Primary U.S. Work Locations

Ohio	Texas
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Umesh Chandra

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.1 Materials
 - └ TX12.1.2 Computational Materials